Attorney Docket No.: 10168.204-US PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Nielsen et al. Confirmation No: 1411

Serial No.: 10/783,254 Group Art Unit: 1761

Filed: February 20, 2004 Examiner: Tran Lien, Thuy

For: Enzymatic Treatment of Starchy Food Products for Shortening the Tempering Step

CERTIFICATE OF MAILING UNDER 37 CFR 1.8(a)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I hereby certify that the attached correspondence comprising:

1. Transmittal of Certified Copy of Priority Application(s)
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Julie Tabarovsky
(name of person mailing paper)

Julie Tabarovsky
(signature of person mailing paper)

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TRANSMITTAL OF CERTIFIED COPY OF PRIORITY APPLICATION(S)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Attached please find two certified copies of the foreign applications from which priority is claimed for this case:

Country: Denmark
Application Number: PA 2001 01354
Filing Date: 18 September 2001

Country: Denmark
Application Number: PA 2002 00052
Filing Date: 14 January 2002

Respectfully submitted,

Date: May 27, 2005

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Patent application No.: PA 2001 01354

Date of filing: 18 September 2001

Applicant: (Name and address)
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DK-2880 Bagsværd
Denmark

Title: Production of edible products

IPC: -

This is to certify that the attached documents are exact copies of the above mentioned patent application as originally filed.

Patent- og Varemærkestyrelsen
Økonomi- og Erhvervsministeriet

05 May 2005

CERTIFIED COPY OF PRIORITY DOCUMENT

Susanne Morsing

PATENT- OG VAREMÆRKESTYRELSEN

PRODUCTION OF EDIBLE PRODUCTS

FIELD OF THE INVENTION

The present invention relates to the preparation of an edible product from raw materials comprising starch and water by heating, cooling, holding and drying.

BACKGROUND OF THE INVENTION

The preparation of some starch-based food products includes a holding step (sometimes known as tempering or ageing) intended to make the starch retrograde sufficiently to make the product acceptable for further processing. This may typically involve holding from 10 to 48 hours at room temperature.

An example is the production of certain snack products (sometimes called third-generation or 3G snacks) in a process including extrusion cooking, followed by cooling, holding and drying to make snack pellets which are expanded by heating (e.g. by frying in oil) to make the final snack product.

Another example is shredded cereals made by cooking whole grain (particularly wheat), followed by cooling, tempering, shredding, forming into biscuits and baking.

The ageing step is by nature a time and space consuming step, and a shortening of this step will give significant advantages to manufactures such as the possibility of reducing floor and rack space or increase production.

SUMMARY OF THE INVENTION

The inventors have found that the addition of an endo-amylase or a debranching enzyme to starch-based raw materials accelerates the retrogradation and thus allows a shortening of the holding period.

Accordingly, the invention provides a process for producing an edible product, comprising the following sequential steps:

a) mixing an endo-amylase or a debranching enzyme with raw materials comprising starch,

b) heating so as to gelatinize the starch,

c) cooling,

d) holding to effect retrogradation of the starch, and

e) heating.

DETAILED DESCRIPTION OF THE INVENTION

Food product

The food product may be snack pellets, a snack product (e.g. a third-generation snack), or shredded cereal (e.g. shredded wheat) for use as a breakfast cereal.

Snack pellets and products

According to the invention, snack pellets may be produced by a process comprising the following sequential steps:

a) mixing an endo-amylase or a debranching enzyme with raw materials comprising starch,

b) extruding and heating the mixture so as to gelatinize the starch,

c) cooling and holding to effect retrogradation of the starch, and

d) heating and drying.

The raw material mixture typically contains up to 32 % water (e.g. 20-32 %), and may optionally be preconditioned by heating, e.g. up to 95°C for 20-240 seconds.

The extrusion cooking may be done in a single-screw or double-screw extruder with a residence time of 30-90 seconds. The extruder will typically comprise a cooking zone at 80-150°C and a forming zone at 65-90°C. After the extrusion with heating, the mixture will be formed into long rods, typically having a temperature of 60-100 °C (particularly 70-95°C) and a moisture content of 25-30 % or 20-28 %. The holding (also termed aging) may take 8-24 hours (particularly 10-16 hours). Before or during the holding, the rods will be cooled, typically to 15-30°C. The holding serves to affect at least partial retrogradation of the starch, either of the amylose component, the amylopectin component or both. Advantageously, the endo-amylase or debranching enzyme added according to the invention accelerates the retrogradation, so the holding time may be shortened. The end-point is conventionally determined by testing the hardness and brittleness of the pellets.

After ageing the rods are cut into pellets.

The drying of the pellets may be done at 70-95°C for 1-3 hours to reach an exit moisture of 6-8 % in the snack pellets.

The dried snack pellets may be stored or distributed to a snack processor. The snack pellets may then be expanded by heating , e.g. by frying in oil or puffing in hot air or in microwave or infrared oven.

Shredded cereals

According to the invention, shredded cereals may be produced by a process comprising the following sequential steps:

a) mixing an endo-amylase or a debranching enzyme with raw materials comprising starch,

b) cooking so as to gelatinize the starch,

c) cooling and holding to effect retrogradation of the starch,

e) shredding, and

f) baking.

Shredded cereals may be made by cooking whole grain, followed by cooling, tempering, shredding, forming into biscuits and baking.

The whole grain may be wheat (e.g. white wheat), rice or corn. The cooking may be done for 30-35 minutes at atmospheric pressure or 2000 hPa to reach 45-50 % moisture after removal of excess water. The holding (or tempering) may take 8-28 hours with cooling to 15-30°C. After shredding, the shreds may be stacked to make a biscuit, and this may be baked at 200-315°C to around 4 % end moisture.

Endo-amylase or debranching enzyme

The invention uses an enzyme which is an endo-amylase or a debranching enzyme. The enzyme may suitably have a pH optimum in the range ?-?. 5-9

The enzyme may suitably have a temperature optimum in the presence of starch in the range of 30-90°C, preferably 50-80°C, particularly 55-75°C, e.g. 60-70°C. The temperature optimum may be measured in a 1 % solution of soluble starch at pH 5.5.

The enzyme is typically used at a dosage of 0.1-20 mg enzyme protein per kg of dry solids in the raw material, particularly 0.5-5 mg/kg.

The endo-amylase may be any enzyme that can hydrolyze alpha-1,4 bonds in amylose in an endo-manner (i.e. in the interior of the molecule). Examples of endo-amylases are alpha-amylase (EC 3.2.1.1) and maltogenic alpha-amylase (EC 3.2.1.133). The alpha-amylase may be derived from *Bacillus*, particularly *B. licheniformis* or *B. amyloliquefaciens*. The maltogenic alpha-amylase may be derived from *B. stearothermophilus*, e.g. strain NCIB 11837 described in EP 120693, or it may be a variant described in US 6162628. The maltogenic alpha-amylase is typically used at a dosage of 20-5000 MANU per kg of dry solids in the raw materials, particularly100-1000 MANU/kg. The MANU unit is defined in US 6197352 B1.

The debranching enzyme may be any enzyme that can hydrolyze alpha-1,6 bonds in amylopectin. Examples are pullulanase (EC 3.2.1.41) and iso-amylase (EC 3.2.1.68).

The pullulanase may be derived from a strain of *Bacillus*, in particular *B. naganoenis* or *B. acidopullulyticus*, a strain of *Clostridium*, in particular *C. thermosulphurogenes* or *C. thermohydrosulphuricum*, or a strain of *Pyrococcus*, in particular *P. woesie* or *P. furiosus*.

The isoamylase may be derived from a strain of *Flavobacterium*, in particular *F. odoratum*, from *Sulfolobus*, in particular *S. acidocaldarius* or *S. acidocaldarius*, or from a strain of *Rhodethermus*, in particular *R. marinus*.

EXAMPLES

Example 1

CLAIMS

1. A process for producing an edible product, comprising the following sequential steps:
   a) mixing an endo-amylase or a debranching enzyme with raw materials comprising starch,
   b) heating so as to gelatinize the starch,
   c) cooling and holding to effect retrogradation of the starch, and
   d) heating and drying.

2. The process of the preceding claim which further comprises a subsequent heat treatment.

3. The process of either preceding claim wherein the edible product is a snack food or a breakfast cereal.

4. A process for producing snack pellets, comprising the following sequential steps:
   a) mixing an endo-amylase or a debranching enzyme with raw materials comprising starch,
   b) heating and extruding the mixture so as to gelatinize the starch and form pellets,
   c) cooling and holding to effect retrogradation of the starch,
   d) heating and drying.

5. The process of the preceding claim which further comprises a heating step prior to the extrusion.

6. A process for producing a snack product comprising
   a) producing snack pellets by the process of any preceding claim, followed by
   b) heat treating the pellets, particularly by frying in oil, puffing in hot air, microwave or infrared oven.

7. A process for producing shredded cereals, comprising the following sequential steps:
   a) mixing an endo-amylase or a debranching enzyme with raw materials comprising starch,
   b) cooking so as to gelatinize the starch,
   c) cooling,
   d) holding to effect retrogradation of the starch, and
   e) shredding, and
   f) baking.